UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB - 7 1994

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Zinc Borate (Borogard ZB) - Evaluation of Leachability Data Submitted by the Registrant and Reviewed by EFGWB/EFED (EPA Registration No. 1624-120)
P.C. Code: 128859
Tox Chem No.: 909B
DP Barcode : D197085
Submission: S454109

FROM: Yiannakis M. Ioannou, Ph.D., Section Head
Review Section I, Toxicology Branch II
Health Effects Division (7509C)
Y M. Ioannou 2/2/94

TO: Denise Greenway/Susan Lewis, PM 21
Fungicide-Herbicide Branch
Registration Division (7505C)

THRU: Marcia van Gemert, Ph.D., Branch Chief
Toxicology Branch II
Health Effects Division (7509C)
M van Gemert 2/3/94

Registrant: U.S. Borax and Chemical Corporation, Los Angeles, CA

Action Requested: Determine if the leachability study, conducted by the Registrant, satisfies the Toxicology data requirements for Section 3 registration of Zinc Borate (Borogard ZB).

Recommendations: Toxicology Branch II has determined that based on the acceptable leachability study conducted by the Registrant and reviewed by EFGWB/EFED the Toxicology data requirements for Zinc Borate (Borogard ZB) are now fulfilled and support Section 3 registration of this chemical.

Background

Borogard ZB is proposed for use as a biocide (Fungicide/ Preservative) additive in the manufacturing of coatings, plastics and wood composite products. For a conditional registration (Registration Notice of July 15, 1991) the Registrant committed to submit to the Agency a dermal sensitization study in guinea pigs and a leachability study as requested by Toxicology Branch II. The dermal sensitization study with Borogard ZB was submitted earlier (memo of March 14, 1991 from Y.M. Ioannou to Susan Lewis) and found to be acceptable. The leachability study was also submitted recently and upon review by Dana Spatz of EFGWB/EFED (review attached) was found to be acceptable and to fulfill the data requirement imposed earlier as part of "Conditional Registration" of Borogard ZB (EPA Reg. No. 1624-120).

Discussion/Conclusions

The purpose of the leachability study was to evaluate the rate of "leaching of zinc and boron ions from a polyvinyl chloride (PVC) shower curtain formulated to contain Borogard ZB (zinc borate) at the maximum rate recommended on the product label for application, and from an acrylic latex topcoat paint formulation into which Borogard ZB had been incorporated". The results of these studies indicate that the maximum amount of zinc leached from PVC in 20 days (at different pHs) was 1.3% and for boron was 2.2%. The maximum amount of zinc leached from an acrylic latex paint formulation in 20 days (at different pHs) was 3.4% and for boron approximately 30%

Data presented in this study define qualitatively and quantitatively leachates of Borogard ZB from finished end-use products and satisfy the Environmental Fate data requirements for use of Borogard ZB as an additive in the plastic, coating and composite products as listed on the label. This study provides adequate exposure information on zinc and boron which may be used for risk assessment purposes.

Toxicology Branch II now believes that all the data requirements for Borogard ZB have been satisfied and has no objections to Section 3 registration of this chemical.

Date Out: OCT 26 1993

DP Barcode: D185338, D185262, D189770
Chemical Code: 128859

ENVIRONMENTAL FATE AND GROUND WATER BRANCH

Review Action

To: Susan Lewis, PM #21
Registration Division (H7505C)

From: Mah T. Shamim, Ph.D., Acting Section Chief
Chemistry Review Section 2
Environmental Fate & Ground Water Branch/EFED (H7507C)
MTShamim OCT 18 1993

Thru: Henry Jacoby, Chief
Environmental Fate & Ground Water Branch/EFED (H7507C)
Henry Jacoby 10/26/93

Attached, please find the EFGWB review of...

Common Name:	Zinc Borate	**Trade name:**	BOROGARD ZB
Company Name:	U.S. Borax, Inc.		
ID #:	1624-120		
Purpose:	Zinc and Boron release rate studies from PVC and acrylic latex paint.		

Type Product:	Action Code:	EFGWB #(s):	Review Time:
fungicide	575	93-0195, -0278, -0559	3 days

STATUS OF STUDIES IN THIS PACKAGE:

Guideline #	MRID	Status[1]
release rate	42700401	A

STATUS OF DATA REQUIREMENTS ADDRESSED IN THIS PACKAGE:

Guideline #	Status[2]
release rate	S

[1] Study Status Codes: A=Acceptable U=Upgradeable C=Ancillary I=Invalid.
[2] Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

1. CHEMICAL:

Common name: Zinc Borate

Structure: $2ZnO \cdot 3B_2O_3 \cdot 3.5H_2O$

Physical/Chemical properties:

formula weight: 434.66
solubility: Less than 0.28 wt.% in water at 25°C.

2. TEST MATERIAL:

a. Flexible PVC plastic impregnated with BOROGARD ZB (100% zinc borate) at 30 phr.

b. Acrylic paint formulation containing 1.0 pound/gallon of BOROGARD ZB (100% zinc borate).

3. STUDY/ACTION TYPE:

Evaluate leach rate studies of zinc and borate ions from a polyvinyl chloride (PVC) shower curtain formulated to contain zinc borate, and from an acrylic latex topcoat paint formulation into which zinc borate had been incorporated.

4. STUDY IDENTIFICATION:

Ourisson, Philippe. "Zinc and Borate Ions: A Leaching Study with BOROGARD ZB." Performed by Centre Analytical Laboratories, Inc. Laboratory Project ID: QAI No. 640-501, completed on March 11, 1993. Submitted by U.S. Borax Inc. Received by EPA on March 18, 1993. MRID #: 427004-01.

5. REVIEWED BY:

Dana Spatz
Chemist, CRS #2
EFGWB/EFED/OPP

Date: SEP 27 1993

6. APPROVED BY:

Mah T. Shamim, Ph.D.
Acting Section Head, CRS #2
EFGWB/EFED/OPP

Date: OCT 18 1993

7. CONCLUSIONS:

Leaching of zinc and borate ions from a polyvinyl chloride (PVC) shower curtain formulated to contain BOROGARD ZB (zinc borate) at the maximum rate recommended on the product label for application, and from an acrylic latex topcoat paint formulation into which BOROGARD ZB had been incorporated, was evaluated.

a. **Leach Rate Study With PVC Impregnated With BOROGARD ZB**

This study is acceptable and together with the acrylic paint study below, fulfills the data requirement imposed as part of the conditional registration of BOROGARD ZB (EPA Reg. No. 1624-120).

In distilled water at pH's 6, 7, and 9, the average release rate of zinc from the PVC over the 20-day exposure period was 1.3, 0.83, and 0.35 $\mu g/cm^2$/day, respectively. The release rate appeared to be pH dependent; decreasing with higher pH. This was expected since the solubility of zinc decreases with increasing pH. At pH 6, the average release rate remained fairly constant, whereas at pH 7 and 9, the rate decreased over time. After 20 days, the maximum amount of zinc leached was 1.3%.

In distilled water at pH's 6, 7, and 9, the average release rate of boron from the PVC over the 20-day exposure period was 1.4, 1.16, 0.86 $\mu g/cm^2$/day, respectively. The release rate was slightly higher at lower pH. After 20 days, the maximum amount of boron leached was 2.2%.

b. **Leach Rate Study With Acrylic Latex Paint Formulation Containing BOROGARD ZB**

This study is acceptable and together with the PVC study, fulfills the data requirement imposed as part of the conditional registration of BOROGARD ZB (EPA Reg. No. 1624-120).

The release rate for both zinc and boron was higher from the acrylic latex paint than from PVC. This was particularly true for boron. In distilled water at pH's 6, 7, and 9, the average release rate of zinc from the acrylic latex paint over the 20-day exposure period was 2.1, 1.2, and 0.28 $\mu g/cm^2$/day, respectively. The release rate appeared to be pH dependent; decreasing with higher pH. This was expected since the solubility of zinc

decreases with increasing pH. After 20 days, the maximum amount of zinc leached was 3.4%.

In distilled water at pH's 6, 7, and 9, the average release rate of boron from the acrylic latex paint over the 20-day exposure period was 19.4, 22.0, and 21.9 $\mu g/cm^2$/day, respectively. The release rate did not appear to be pH dependent and was significantly higher than in the PVC system. The release rates decreased from approximately 27 $\mu g/cm^2$/day at day 6 to approximately 12 $\mu g/cm^2$/day at day 20 at all three pH's. After 20 days, the maximum amount of boron leached was 30%.

8. RECOMMENDATIONS:

A condition of registration of zinc borate (BOROGARD ZB, 1624-120) required that an acceptable "product leaching study" be submitted that would qualitatively and quantitatively define leachates from finished end-use-products. All Environmental Fate data requirements for the use of the fungicide/biocide BOROGARD ZB as an additive in the plastic, coating, and wood composite products listed on the product label have been satisfied.

Under the conditions of the study, (i.e., pH 6, 7, and 9 at 35°C), borate ions and, to a lesser extent, zinc ions leached from the PVC and acrylic latex paint end-use-products. This data on the availability of zinc and boron provides exposure information that may be used for risk assessment purposes.

9. BACKGROUND:

BOROGARD ZB (zinc borate) is a free flowing, readily dispersible, white powder, that may be used as a corrosion inhibitor in both organic solvent-based and water-borne coatings, and as a preservative/fungicide in coating systems, plastic and rubber products, and wood composite materials. Currently, the only outdoor uses of BOROGARD ZB are polyolefin wire and cables, PVC tenting and awnings, and acrylic roof coatings. Zinc borate acts as a fungicide and mildewcide, preventing or retarding the growth of mildew-like fungi. Conditional registration was granted on July 15, 1991.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

Materials and Methods

The test substance was identified as BOROGARD ZB 12E5E8. Prior to the conduct of the leaching procedure, the test substance was digested for characterization. The characterization consisted of the determination of its concentration (in percent) of both B and Zn, as identification of the strength and purity of the test substance. Three samples of the test substance were analyzed on an Inductively Coupled Plasma Spectrophotometer (ICP) for Zinc (Zn) and Boron (B) concentration.

Two test systems were included in this study; one consisted of a standard plastic (PVC) and one was a top-coat paint. Each contained zinc borate in the form of BOROGARD ZB. These were evaluated for leaching of boron and zinc using an extraction cell and DI water (adjusted to three different pH values) as the extraction solvent.

Flexible PVC plastic was impregnated with BOROGARD ZB at 30 phr (parts per hundred parts polymer resin). This loading is typical of a PVC shower curtain formulation. The PVC plastic sheet was cut into samples measuring 3" x 1.25". The acrylic paint formulation contained 1.0 pound/gallon of BOROGARD ZB. The paint was spread on a flat teflon surface to obtain a paint dry film thickness of approximately 16 mils. After completely dry, the film was removed from the preparation surface, and cut into samples measuring 3" x 1.25". A full characterization of both formulations was made. The characterization was performed by an acid digestion of the test systems using an analytical microwave oven. The analysis was performed using an ICP spectrophotometer for the leachate samples. This procedure was used to measure the entire content of Zn and B in the samples. The PVC sample contained 15.7% BOROGARD ZB, or 4.7% Zn and 2.3% B. The acrylic paint contained 22.6% BOROGARD ZB in the dry film, or 6.8% Zn, and 3.4% B.

A total of 36 PVC and 36 paint strips (3 pH's x 4 time periods x 3 replicates) were placed in 60 ml polyethylene jars so that loosely curled crescents were formed. In addition, there were 9 additional jars in which no samples were placed (0-day). Jars were separated into 3 sets of 12 jars each for the PVC and paint samples, and 3 jars each for the 0-day jars.

50 ml of DI water (to which 2 ml/L of 1 M KCl was added to allow a reliable pH measurement to be taken), adjusted to pH 6.0 ± 0.25 was added to the 27 jars in the first set. The pH was adjusted using dilute NaOH or dilute HCl. The same

amount of water (and KCl) was added to the 27 jars in the next set, but with the pH adjusted to 7.0 ± 0.25. Lastly, the same amount of water (and KCl) was added to the 27 jars in the third set, but with the pH adjusted to 9.0 ± 0.25. Each sample was weighed. The plastic strips and acrylic paint strips were placed in the leaching solution, except the 0-day. A teflon-coated magnetic stir-bar was added to each sample, except the 0-day.

Each jar was capped with a teflon-lined cap and placed into a water bath maintained at 35°C ± 0.1°C. The 0-day jars were removed after one hour, and the digestion and analysis was conducted as described below. The pH of each solution was monitored each work day and adjusted as necessary. After about one week, the pH of the samples stabilized to the point where it was possible to only monitor the samples once every two working days, which was instituted after day 10 of the leaching.

Three jars were removed from each set (pH level) after 1, 6, 9, and 20 days and the leaching solution was digested and analyzed as described below. In order to determine if a steady state condition had been reached, the PVC or paint strips from the 20 day samples were placed into a fresh solution at the appropriate pH and re-exposed for an additional 6 days; the leaching solution was then digested and analyzed as described below. After the given days of exposure, the final pH of the solution in each jar was measured. The solution was filtered through a VWR 474 filter paper and collected in a pre-weighed flask. The test article and test vial were rinsed with small portions of DI water which were combined with the filtrate. The final volume was adjusted by weight to 100 ml (100 g) with DI water to standardize the final volume.

The sample was shaken, and exactly 50 ml of well-mixed sample was transferred to a teflon digestion vessel. To the sample was added 5.0 ml of concentrated HNO_3 and 5.0 ml of concentrated HCl. The sample was then digested in the microwave oven as described in the standard EPA method SW 846, method 3015. The sample was cooled and filtered. Sample volume was adjusted to 100 ml with DI water and analyzed by ICP.

11. COMPLETION OF ONE-LINER:

Amended as appropriate.

12. CBI APPENDIX:

Not applicable.